



22147203

**MATHEMATICS
HIGHER LEVEL
PAPER 1**

Candidate session number

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Tuesday 13 May 2014 (afternoon)

Examination code

2 hours

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INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- You are not permitted access to any calculator for this paper.
- Section A: answer all questions in the boxes provided.
- Section B: answer all questions in the answer booklet provided. Fill in your session number on the front of the answer booklet, and attach it to this examination paper and your cover sheet using the tag provided.
- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.
- A clean copy of the **Mathematics HL and Further Mathematics HL formula booklet** is required for this paper.
- The maximum mark for this examination paper is [120 marks].



16EP01

7. [Maximum mark: 5]

The triangle ABC is equilateral of side 3 cm. The point D lies on [BC] such that $BD = 1$ cm. Find $\cos \hat{D}AC$.

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13. [Maximum mark: 17]

A geometric sequence $\{u_n\}$, with complex terms, is defined by $u_{n+1} = (1+i)u_n$ and $u_1 = 3$.

(a) Find the fourth term of the sequence, giving your answer in the form $x + yi$, $x, y \in \mathbb{R}$. [3]

(b) Find the sum of the first 20 terms of $\{u_n\}$, giving your answer in the form $a \times (1 + 2^m)$ where $a \in \mathbb{C}$ and $m \in \mathbb{Z}$ are to be determined. [4]

A second sequence $\{v_n\}$ is defined by $v_n = u_n u_{n+k}$, $k \in \mathbb{N}$.

(c) (i) Show that $\{v_n\}$ is a geometric sequence.

(ii) State the first term.

(iii) Show that the common ratio is independent of k . [5]

A third sequence $\{w_n\}$ is defined by $w_n = |u_n - u_{n+1}|$.

(d) (i) Show that $\{w_n\}$ is a geometric sequence.

(ii) State the geometrical significance of this result with reference to points on the complex plane. [5]

